

**CALIFORNIA COASTAL COMMISSION**

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**STAFF RECOMMENDATION****ON CONSISTENCY DETERMINATION**

Consistency Determination No.	<b>CD-16-00</b>
Staff:	MPD-SF
File Date:	2/16/2000
45th Day:	4/1/2000
60th Day:	4/16/2000
Commission Meeting:	4/14/2000

**FEDERAL****AGENCY:****U.S. Geological Survey (USGS)****PROJECT****LOCATION:**

Southern California offshore waters, nearshore areas to 20 mi. offshore, between Port Hueneme, Ventura Co., and the U.S.-Mexican Border (Exhibit 1)

**PROJECT****DESCRIPTION:**

Seismic survey to map earthquake faults and other subsea stratigraphic information (Exhibit 2)

**SUBSTANTIVE****FILE****DOCUMENTS:**

See page 16.

**EXECUTIVE SUMMARY**

The U.S. Geological Survey (USGS) has submitted a consistency determination for a seismic survey in southern California offshore waters to collect high-resolution seismic reflection data to investigate: (1) landslide and earthquake hazards in the nearshore region from Los Angeles to San Diego; and (2) saltwater intrusion into freshwater aquifers that provide water supply for the Los Angeles-San Pedro area. The survey would take three weeks to complete and is scheduled for June 2000.

Seismic surveys usually involve loud seismic pulses which can disturb marine resources. For example, most oil exploration seismic surveys use very loud and often multiple airguns, with sounds on the order of 230-259 decibels (dB) (water reference standard (at 1 meter))<sup>1</sup>. Typical oil company surveys use airgun sizes on the order of thousands of cubic inches. Last year's USGS survey (see next paragraph) used a much smaller, 40 cu. inch airgun, which had a maximum sound level of 220 dB. For this year's survey USGS proposes an even quieter device, a low energy (according to State Land Commission definitions), 1.5 kiloJoule (kJ) "SQUID 2000" minisparker system. The maximum sound level for this minisparker is 209 dB.

On May 11, 1999, the Commission objected to USGS' consistency determination for the 1999 southern California seismic survey, based on concerns over nighttime operation when visibility (and therefore ability to monitor for the presence of marine mammals) is limited. That project was subsequently authorized to proceed when USGS agreed to avoid nighttime use of the main airgun. USGS' current proposal to use the minisparker instead of an airgun has several benefits. From an acoustic standpoint, the 180 dB area of acoustic footprint is much smaller, enabling USGS, even at night, to maintain visibility within the area for preclusion of marine mammals. From a procedural standpoint, use of this device enables USGS to receive State Lands Commission approval and work in State waters. Absent an EIR, the State Lands Commission only allows devices which it considers low-energy, defined as having an energy output of less than 2 kiloJoules. Thus, for this year's survey, unlike the 1999 survey as ultimately carried out, USGS proposes to operate both at night and in State waters.

Nevertheless, even with this reduced output, the USGS' survey is sufficiently loud to raise concerns over effects on marine mammals and trigger the need for monitoring and avoidance measures. Accordingly, USGS has committed to monitoring marine mammals in the survey vicinity and avoiding subjecting marine mammals to sound levels above 180 dB. Because of the different dispersion between deep water (where spherical spreading is the rule) and shallow water (where waves scatter noise at the surface and the subsea floor absorbs a certain percentage of the sound) USGS expects the sound to attenuate to 180 dB at 30 meters (m) from the source in deep water and at 15 m in shallow waters. Therefore, USGS has committed that the minisparker operations will cease when marine mammals are within 30 m of the sound source when operating in deep water, and within 15 m when operating in shallow water. In addition, the project has been timed to avoid the gray whale migration season.

Given the relatively low energy level of the minisparker device, along with USGS' proven ability to monitor and protect marine mammals in its past surveys, with the monitoring and avoidance commitments the project is consistent with the marine resource, environmentally sensitive habitat, commercial and recreational fishing and diving policies (Sections 30230, 30240, 30234, 30234.5, 30213 and 30220) of the Coastal Act.

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<sup>1</sup> All decibel references in this report will be based on the water standard (re: 1 micropascal (μPa))

## **STAFF SUMMARY AND RECOMMENDATION**

**I. Project Description.** USGS proposes a seismic survey in southern California offshore waters in order to: (1) evaluate seismic hazards from active nearshore faults adjacent to densely populated urban areas; and (2) provide stratigraphic control for aquifer models in the Los Angeles Basin necessary for the study and management of saltwater intrusion. The area proposed for study is located within the marine environment of southern California, between Port Hueneme and the U.S.-Mexican Border, extending from nearshore to a maximum of 20 miles offshore (Exhibit 1). The surveys are part of a multiyear effort and are being conducted in cooperation with local city and county groundwater management agencies (e.g., the Los Angeles County Department of Public Works and the Southern California Water Replenishment District). The project is currently scheduled to be conducted for three weeks in June 2000.

During the survey the USGS will operate two sound sources. The primary sound source will be a 1.5 kiloJoule (kJ, or kJoule) sparker “SQUID 2000” minisparker system (manufactured by Applied Acoustic Engineering, Inc.). This minisparker includes eight electrodes that are mounted on a small pontoon sled. The electrodes simultaneously discharge electric current through the seawater to an electrical ground, creating an acoustic signal. The pontoon sled that supports the minisparker is towed on the sea surface, approximately 20 meters behind the ship.

The maximum sound pressure level (SPL) of the minisparker is 209 dB re 1  $\mu$ Pa-m RMS<sup>2</sup>. Most of the sound energy lies between 150 Hertz (Hz) and 1700 Hz, with a peak amplitude at 900 Hz (Exhibit 3). The sound pulse has a duration of about 0.8 milliseconds (ms), and for this survey, the minisparker will be discharged every 4 to 6 seconds. A second, higher frequency seismic source, which was also used during last year’s survey, is the “Huntec” system. This system uses electro-magnetically driven plates to produce an acoustic pulse every 0.5 seconds. This sound source is towed approximately 100 meters behind the ship in water depths greater than 200 m. In shallow water, this source will be within 5 m of the sea surface. The SPL for this source is 205 dB re 1  $\mu$ Pa-m RMS, and the frequencies for this source are between 500 Hz and 8 kiloHertz (kHz), with a peak amplitude at 4.5 kHz.

The following table provides the sources’ acoustic characteristics:

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<sup>2</sup> re 1  $\mu$ Pa-m RMS stands for one micropascal measured at one meter from the sound source root mean square, which is a term used to describe underwater sound pressure level (SPL) at one meter from the source. Root mean square means “average pressure squared over the pulse duration” (i.e., the average acoustic energy over the duration of the pulse).

Table 1 - Acoustic Source Characteristics

System	“SQUID” minisparker	Huntec (boomer)
Power	1.5 kiloJoules 209 dB RMS	340 Joules 205 dB RMS
Frequency range	150-1700 Hz	0.5 to 8 kHz
Repetition rate	4 to 6 sec	0.5 to 1 sec
Towing depth	surface	10-100 meters
Pulse duration	0.8 msec typical	0.34 msec typica

(Note: all dB units are referenced to 1 micropascal @ 1 meter)

**II. History of Commission Review of Oil Industry Seismic Surveys.** In the 1980s hundreds of oil company seismic surveys were conducted in California offshore waters pursuant to joint permits issued by the Minerals Management Service (MMS) and the State Lands Commission. The Commission staff received notices of the surveys but did not choose to regulate the activities. The major issues the Commission staff was aware of at that time were: (1) impacts to commercial fishing equipment from the long tow lines used by the oil companies; and (2) impacts of loud noises on fish catch and fish development (e.g., eggs and larvae development). Current concerns over effects of low frequency noise on marine mammals had not evolved at that time. In addition, part of the reason the Commission staff declined to assert jurisdiction at that time was the existence and success of the joint oil and fisheries liaison office in the Santa Barbara Channel, which mediated disputes between fishermen and oil companies.

In once instance in 1988 the Commission attempted to assert jurisdiction over an Exxon seismic survey in northern California waters which conflicted with peak salmon fishing season; however after Exxon met with fishing groups and agreed to modify its activity to avoid the peak fishing season, the Commission rescinded its request to review the “unlisted permit” activity.<sup>3</sup>

In 1994 the Commission staff issued a “no coastal development permit” letter to the Thums Long Beach Company for a seismic survey in State waters just offshore of Long Beach. Marine mammal and fisheries avoidance measures were incorporated into this survey and the survey was of short duration. In 1995 the Commission staff agreed with a “No Effects” determination by Exxon for a seismic survey at the Santa Ynez unit in federal waters offshore

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<sup>3</sup> Pursuant to 15 CFR Part 930, Section 930.54, Unlisted federal license and permit activities.

of Santa Barbara County. The Commission agreed not to require a consistency certification in part due to Exxon's incorporation of marine mammal protection measures, including visual,

aerial and acoustic monitoring, acoustic model verification, marine mammal preclusion/avoidance areas, and other measures being required under the National Marine Fisheries Service (NMFS) marine mammal harassment permit.

**III. History of Commission Review of USGS Seismic Surveys.** In 1991 the Commission concurred with USGS' consistency determination for a seismic survey in the San Francisco Bay Region (CD-47-91). The Commission found that the activity would: (1) avoid important fishing grounds; (2) only be conducted for one or two days within areas of Coastal Commission jurisdiction (as opposed to within San Francisco Bay, which comes under the purview of the San Francisco Bay Conservation and Development Commission (BCDC)); and (3) be consistent with the marine resources policies of the Coastal Act. That survey involved use of a relatively large airgun array (10 guns, 5828 cu. in.). The monitoring report concluded that the airgun profiling did not alter the feeding behavior of sea lions, seals, or pelicans, all of which were observed feeding in parts of the study area.

USGS has performed three subsequent surveys in Pacific Ocean waters, two in 1998 and one in 1999. The first was in Puget Sound and the next two in southern California. For the Puget Sound survey, USGS used a 16-gun, 5,300 cu. in. array. Extensive monitoring documented no adverse effects to marine life. The Commission staff was not aware of USGS' 1998 southern California survey, and it was not reviewed by the Commission. That survey took place in December 1998 and included marine mammal protection measures and extensive monitoring. As discussed elsewhere in this report, the Commission did review USGS' consistency determination for the 1999 southern California survey. That survey involved use of a small, 40 cu. inch airgun, and the monitoring results are attached as Exhibit 5.

**IV. Project Benefits.** The work that the USGS proposes will have definite benefits to the State and to society at large. Near-shore high resolution seismic reflection data allow detailed analysis of the stratigraphy of the uppermost (geologically youngest) sediments, interpretation of geologic structures, and, when used in conjunction with independent data providing age constraints, allow for the analysis of the timing of sedimentation, deformation, or faulting events.

The data that USGS proposes collect will initially be used in two independent studies. The first, an evaluation of aquifers impacted by saltwater intrusion in the Los Angeles basin, promises immediate and direct benefits to the people of the greater Los Angeles area. The City of Los Angeles currently obtains over a third of its freshwater supply from aquifers in the Los Angeles basin. Early in this century, these aquifers began to be impacted by saltwater intrusion related to excessive groundwater withdrawal. As freshwater is removed from the aquifer, saltwater offshore flows into the areas of active pumping. In order to prevent this inflow, local water companies began injecting freshwater into the aquifer to produce three hydraulic pressure ridges to serve as dams against saltwater intrusion. These dams have been largely successful, but the Dominguez Gap Barrier, on the eastern side of the Palos Verde Peninsula, is currently leaking, allowing saltwater to contaminate the aquifer. The leakage seems to be the result of a poor understanding of the detailed geometry of the aquifer in the area immediately

offshore. A better understanding of the configuration of permeable and impermeable layers will allow for a reconfiguration and “repair” of the barrier. The detailed data that would be provided by the USGS study could help provide that understanding.

The second study will use the seismic reflection data to help understand how deformation related to active faulting is distributed offshore. Our understanding of the relative activity of the many active and potentially active faults paralleling the southern California coast is incomplete. Many important faults, including the Newport-Inglewood and Rose Canyon Faults, lie just offshore and have not been accurately imaged by modern techniques. Knowing the location and geometry of these and other fault systems is critical to estimating the location and severity of ground shaking associated with earthquakes occurring along them. Placing age constraints on breaks in sedimentation associated with these faults will provide information on long-term slip rates and earthquake recurrence intervals, allowing the assessment of earthquake probability on the offshore segments of these fault systems. This information is of obvious important to planners in making decisions about land use and hazard zonation.

Both of these projects are interdisciplinary, and are undertaken in close cooperation with interested institutions and agencies, including the Los Angeles County Department of Public Works, the Water Replenishment District of Southern California, Scripps Institute of Oceanography, and the Southern California Earthquake Center. USGS plans to disseminate this information not only through their own publications and refereed journal articles, but also in the form of public meetings and workshops.

**V. Federal Agency's Consistency Determination.** The USGS has determined the project consistent to the maximum extent practicable with the California Coastal Management Program.

**VI. Staff Recommendation.** The staff recommends that the Commission adopt the following motion:

**MOTION:**                    ***I move that the Commission agree with consistency determination CD-16-00 that the project described therein is fully consistent, and thus is consistent to the maximum extent practicable, with the enforceable policies of the California Coastal Management Program (CCMP).***

**STAFF RECOMMENDATION:**

Staff recommends a **YES** vote on the motion. Passage of this motion will result in an agreement with the determination and adoption of the following resolution and findings. An affirmative vote of a majority of the Commissioners present is required to pass the motion.

**RESOLUTION TO AGREE WITH CONSISTENCY DETERMINATION:**

The Commission hereby **agrees** with the consistency determination by USGS, on the grounds that the project described therein is fully consistent, and thus is consistent to the maximum extent practicable, with the enforceable policies of the CCMP.

**VII. Findings and Declarations:**

The Commission finds and declares as follows:

**A. Marine Resources/Environmentally Sensitive Habitat.**

**1. Coastal Act Policies.** Section 30230 of the Coastal Act provides:

*Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Section 30240 provides:

*(a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas.*

*(b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade such areas, and shall be compatible with the continuance of such habitat areas.*

**2. Marine Species.** The Southern California Bight supports a diverse assemblage of 29 species of cetaceans (whales, dolphins and porpoises) and 6 species of pinnipeds (seals and sea lions). The species of marine mammals that are likely to be present in the seismic research area include the bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), killer whale (*Orcinus orca*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), northern right whale dolphin (*Lissodelphis borealis*), Risso's dolphin (*Grampus griseus*), pilot whale (*Globicephala macrorhynchus*), Dall's porpoise (*Phocoenoides dalli*), sperm whale, humpback whale (*Megaptera novaengliae*), gray whale (*Eschrichtius robustus*), blue whale (*Balaenoptera musculus*), minke whale (*Balaenoptera acutorostrata*), fin whale (*Balaenoptera physalus*), harbor seal (*Phoca vitulina*), elephant seal (*Mirounga angustirostris*), northern sea lion (*Eumetopias jubatus*), and California sea lion (*Zalophus californianus*), northern fur seal (*Callorhinus ursinus*) and sea otter (*Enhydra lutris*) (NMFS, Fed. Reg., 3/5/99).



**3. Issues.** Marine mammals rely on sound for communication, orientation, and detection of predators and prey. In recent years the Commission's and the public's awareness of the effects of underwater noise, particularly low frequency noise, has increased significantly. In reviewing the Scripps' ATOC<sup>4</sup> and the Navy's LFA<sup>5</sup> research efforts, the Commission noted: (1) the growing evidence that anthropogenic sounds can disturb marine mammals (Richardson et al. 1995); (2) that observed mammal responses to such sounds include silencing, disruption of activity and movement away from the source; and (3) that low frequency sound carries so well underwater that animals "... have been shown to be affected many tens of kilometers away from a loud acoustic source."

Seismic surveys, when conducted with extensive airgun arrays, are among the very loudest of anthropogenic sounds. Richardson et al. (1995) notes that "Peak levels of sound pulses from airgun arrays are much higher than the continuous sound levels from any ship or industrial noise." The maximum noise attributed to an oil exploration array is 259 dB; the general range for such surveys is 230-259 dB. Last year's USGS survey, which used a single (and relatively small) airgun, had a maximum source level of 220 dB. USGS' current proposal would be significantly quieter than even last year's small airgun; the proposed "SQUID" minisparker has a maximum source level of 209 dB RMS.<sup>6</sup> Nevertheless, as noted in the Commission's previous review of last years' USGS survey, any *received* level above 180 dB may raise cause for concern and warrant the need for monitoring and avoidance measures. The proposed survey is partly located within the coastal zone, and it triggers the need for National Marine Fisheries Service (NMFS) "take" permit under the Marine Mammal Protection Act (MMPA).<sup>7</sup> Therefore the Commission believes the survey would clearly affect the coastal zone and needs to be carefully reviewed for its marine resource impacts.

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4 Scripps Institution of Oceanography, Acoustic Thermometry of Ocean Climate (ATOC) Project and Marine Mammal Research Program (MMRP), CC-110-94/CDP 3-95-40.

5 Consistency Determinations No. CD-95-97 and CD-153-97 (Navy, Low-Frequency Active (LFA) Sonar, Phases I and II).

6 Root mean square - see footnote, page 3.

7 For purposes of NMFS review under the Marine Mammal Protection Act of 1973 (MMPA) and, for endangered marine mammals, the Endangered Species Act (ESA) of 1973, and their respective amendments, which prohibit taking (including harassment, harm, and mortality), unless under permit or authorization or exempted from the provisions of these Acts.

**4. Project Impacts.** USGS' application to NMFS for an Incidental Harassment Authorization describes the sound sources' maximum potential noise levels as follows:

***Maximum Sound Exposure Levels for Marine Mammals***

*The adverse effects of underwater sound on mammals have been documented for exposure times that last for tens of seconds or minutes, but effects have not been documented for the brief pulses typical of the minisparker (0.8 ms) and the Hunttec system (typically 0.3 ms). The Natural Marine Fisheries Service (NMFS) proposed that the maximum SPL to which mysticetes and sperm whales can be exposed is 180 dB re 1  $\mu$ Pa-m RMS, but for odontocetes and pinnipeds, the level is 190 dB re 1  $\mu$ Pa-m RMS. In 1999, the California Coastal Commission limited this maximum sound exposure level to 180 dB re 1  $\mu$ Pa-m RMS for all marine mammals.*

*Below we provide two estimates of how closely marine mammals can approach the minisparker source before it needs to be shut off. The first estimate follows the procedure required by the California Coastal Commission in 1999, in that underwater sound is assumed to attenuate with distance according to  $20\log(R)$ , and the maximum SPL to which marine mammals can be exposed is 180 dB re 1  $\mu$ Pa-m RMS. The alternative estimate of safe distance is proposed for operations in shallow water. In shallow water, sound from the minisparker will decay with distance more sharply than  $20\log(R)$  because some of the sound energy will exit the water and penetrate the sea floor when the minisparker source is physically close to the sea floor.*

*In the deeper water (>50 m) areas of the proposed survey, the zone of influence for the minisparker is a circle whose radius is the distance from the source to where the SPL is reduced to 180 dB re 1  $\mu$ Pa-m RMS. For a  $20\log(R)$  sound attenuation, the zone of influence for a 209 dB RMS source has a radius of about 30 m.*

*Much of that part of the 2000 survey that focuses on saltwater intrusion of coastal aquifers will be conducted close to shore, where water is shallow. In such areas, underwater sound commonly attenuates more sharply than  $20\log(R)$  because sound exits the water layer and penetrates into the substrate. In 1999 the USGS measured a sound attenuation of  $27\log(R)$  off southern California, so we propose that for inshore areas, underwater sound attenuates approximately like  $25\log(R)$ . Strictly for inshore areas, then, an attenuation of  $25\log(R)$  yields a zone of influence with a radius of 15 m.*

*Because of this short radius of the zone of influence in shallow water, we propose that the minisparker can be used at night, using spotlights to illuminate the zone of influence around the tow sled.*

As originally proposed for last year's USGS survey (but objected to by the Commission)  
USGS proposes 24-hour surveying. USGS states:

***The Need for 24hour Seismic Operations** Reasons for around the clock operation that benefit the environment are: 1) when the minisparker ceases to operate, marine mammals might move back into the survey area and incur an increased potential for harm when operations resume, and 2) daylight only operations prolong our activities in a given area, thus increasing the likelihood that marine mammals will be harassed. The 2000 survey will require only three weeks, and it will be spread out geographically from Los Angeles to San Diego, so no single area will see long term activity. In our view, the best course is to complete the experiment as expeditiously as possible.*

*Operating less than 24 hours each day incurs substantially increased cost for the leased ship, which the USGS cannot afford (Normark et al., 1999). The ship schedule provides a narrow time window for this project; typically, other experiments are scheduled to precede and follow ours. Thus we are not able arbitrarily to extend the survey time to include large delays for dark or poor visibility.*

*For these reasons, we request that the Incidental Harassment Authorization allow 24-hour operations. We specifically request permission to operate at night with the understanding that we will survey only in shallow water.*

USGS analyzes the project's impacts on marine mammals as follows:

***Potential Effects of Seismic Surveys on Marine Mammals** During seismic reflection surveys, the chief concern is that marine mammals might be disturbed by underwater noise from the seismic sources. The survey vessel may constitute a secondary noise source. Also, the physical presence of a vessel could lead to some nonacoustic effects involving visual or other cues. Depending upon ambient conditions and the sensitivity of the receptor, underwater sounds produced by open water seismic operations may be detectable a substantial distance away from the activity. Any sound that is detectable is (at least in theory) capable of eliciting a disturbance reaction by a marine mammal or of masking a mammalian signal of comparable frequency content. An incidental harassment take is presumed to occur when marine mammals in the vicinity of the seismic source (or vessel) react to the generated sounds or visual cues.*

*Seismic pulses are known to cause some species of whales, including gray and bowhead whales, to behaviorally respond within a distance of several kilometers (Richardson et al. 1995). Although some limited masking of low frequency sounds is a possibility for those species of whales using low frequencies for communication, the intermittent nature of seismic source pulses will limit the extent of masking. Bowhead whales, for example, are known to continue calling in the presence of seismic survey sounds, and their calls can be heard between seismic pulses (Richardson et al. 1995).*

*When the received levels of noise exceed some behavioral reaction threshold, cetaceans will show disturbance reactions. The levels, frequencies, and types of noise that will elicit a response vary between and within species, individuals, locations and season. Behavioral changes may be subtle alterations in surface dive respiration cycles. More conspicuous responses, include changes in activity or aerial displays, movement away from the sound source, or complete avoidance of the area. The reaction threshold and degree of response are related to the activity of the animal at the time of the disturbance. Whales engaged in active behaviors such as feeding, socializing, or mating are less likely than resting animals to show overt behavioral reactions, unless the disturbance is directly threatening.*

*We emphasize that marine mammals are not expected to suffer permanent hearing damage from the survey proposed herein. Temporary threshold shift (TTS), a protective accommodation for loud sounds by mammalian ears, might occur in animals that venture to within a few meters of the minisparker source. However, planned monitoring and mitigation measures (described below) are designed to detect marine mammals occurring near the seismic array and to avoid, to the greatest extent practicable, exposing them to sound pulses that have any possibility of causing even temporary hearing damage.*

***Estimated Number of Marine Mammals that Might be Incidentally Harassed*** Table 1 [Exhibit 4] gives our estimate of the number of marine mammals that might be incidentally harassed during the 2000 survey. The estimated mammal populations (Calambokidis and Francis, 1994) are also shown in Table 1. In 1998 the USGS conducted a survey using a GI gun off southern California, under the supervision of marine mammal biologists; one biologist was on watch at any given time during survey activities.

*We emphasize that the survey planned for this year (2000) will not use a GI gun and that the minisparker is a much less powerful sound source, so the number of mammals that might be incidentally harassed will be substantially lower than in 1998 and 1999.*

*The second column from the right in Table 1 gives the numbers of marine mammals that were observed during the 1998 survey, which was conducted with a 40 [cu.] in. airgun. The last (rightmost) column gives the number of actual sightings during the 1999 seismic reflection survey, during which there were two marine mammal biologists on watch during all hours of operation (Quan and Calambokidis, 1999). The high number of sightings of dolphins during the 1999 cruise is consistent with the observation in the report by Quan and Calambokidis (1999) that the (common dolphin) “..... species often approaches the boat to bow ride thus causing the high number of shutdowns when this species was encountered.”*

*We note especially that the marine mammal observers who accompanied the 1999 survey concluded that “Marine mammal movements and behaviors observed during the*

*seismic reflection operations, revealed no apparent patterns of avoidance and none could be interpreted as harassment.”(Quan and Calambokidis, 1999).*

*Our estimate of the number of marine mammals that might be harassed (Table 1) is based on the population of each mammal type, on its distribution relative to the nearshore survey area, and on the number of individuals that were observed during the 1998 and 1999 seasons.*

As it agreed to for last year’s survey, USGS: (1) has agreed to use a 180 dB exclusion area for both odontocetes and mysticetes; (2) will avoid the gray whale migration season; (3) will monitor marine mammal presence and cease operating whenever a mammal would be exposed to > 180 dB. USGS has committed that the minisparker operations will cease when mysticetes and odontocetes approach within 30 m of the sound source when operating in deep water, and within 15 m when in shallow water. However, for pinnipeds (seals and sea lions), USGS is proposing the same exclusion radii, with the following exception:

*For pinnipeds (seals and sea lions), if the research vessel approaches a pinniped, a safety radius of 30 m around the seismic source when operating in deep water and 15 m when in shallow water, as outlined above, will be maintained from the animal(s). However, if a pinniped approaches the towed minisparker source, the USGS will not be required to shutdown the minisparker. Experience indicates that pinnipeds will come from great distances to scrutinize seismic reflection operations. Seals have been observed swimming within airgun bubbles, 10 m (33 ft) away from active arrays. More recently, Canadian scientists, who were using a high frequency seismic system that produced sound closer to pinniped hearing than will the USGS minisparker, describe how seals frequently approached close to the seismic source, presumably out of curiosity. Therefore, because pinnipeds indicate no adverse reaction to seismic noise, the abovementioned mitigation plan has been proposed. Instead, the USGS will gather information on how often pinnipeds approach the minisparker on their own volition, and what effect the minisparker appears to have on them.*

**5. Monitoring.** USGS will maintain marine biologists onboard the seismic vessel who will have the authority to stop minisparker operations whenever a mammal enters the safety zone. These observers will monitor the safety zone to ensure that no marine mammals enter the zone, and record observations on marine mammal abundance and behavior. If observations are made that one or more marine mammals of any species are attempting to beach themselves when the seismic source is operating in the vicinity of the beaching, the minisparker will be immediately shut off. Finally, any stranding in the vicinity of the survey will be investigated to determine whether a reasonable chance exists that the minisparker survey caused the animal’s death. If NMFS determines, based upon a necropsy of the animal(s), that the death was likely due to the seismic source, the survey shall cease until procedures are altered to eliminate the potential for future deaths.

USGS describes its monitoring program as follows:

***Monitoring Minisparker Use*** Monitoring of marine mammals while the minisparker is active will be conducted 24 hours each day. Trained marine mammal observers will be onboard the seismic vessel to mitigate the potential environmental impact from minisparker use and to gather data on the species, number and reaction of marine mammals to the minisparker. Each observer will use Tasco 7x50 binoculars with internal compasses and reticules to record the horizontal and vertical angle to sighted mammals. Nighttime operations in shallow water will be conducted with a spotlight to illuminate the radius of influence around the minisparker tow sled.

Monitoring data to be recorded during minisparker operations include which observer is on duty and what the weather conditions are like, such as Beaufort Sea state, wind speed, cloud cover, swell height, precipitation and visibility. For each mammal sighting the observer will record the time, bearing and reticule readings, species, group size, and the animal's surface behavior and orientation.

Observers will instruct geologists to shut off the minisparker whenever a marine mammal enters a safety zone.

***Reporting*** The USGS will contract with the qualified marine mammal observers to provide an initial report to NMFS within 160 days of the completion of the 2000 phase of the marine seismic project. This report will provide dates and locations of seismic operations, details of marine mammal sightings, and estimates of the amount and nature of all takes by harassment. A final technical report will be provided by USGS within 1 year of completion of the 2000 phase of the marine seismic project. The final technical report will contain a description of the methods, results, and interpretation of all monitoring tasks.

Monitoring reports from USGS' southern California 1998 survey indicated no adverse environmental impacts. Monitoring results for the 1999 survey (CD-32-99) state: "Marine mammal movements and behaviors observed during the seismic-reflection operations revealed no apparent patterns of avoidance and none could be interpreted as harassment." Those monitoring results are attached as Exhibit 5. Also, USGS agrees to submit the monitoring report for the currently proposed survey to the Commission staff.

**6. Commission Conclusion.** As noted in its review of USGS's 1999 survey, NMFS' recent "pulsed power" exercise, and Navy LFA and Scripps ATOC acoustic research activities, the Commission remains concerned over the lack of reliable information regarding the effects of underwater sounds on the marine environment. To the extent it can be argued that a consensus exists, a 180 dB threshold for impulse noises such as those in seismic surveys has generally been accepted in determining the appropriate preclusion areas for marine mammals. USGS' proposed survey would be consistent with this "guideline." As discussed above, because of the different dispersion between deep water (where spherical spreading is the rule) and shallow water (where waves scatter noise at the surface and the subsea floor

absorbs a certain percentage of the sound) USGS expects the sound to attenuate to 180 dB at 30 meters (m) from the source in deep water and at 15 m in shallow waters.

The Commission staff has requested that USGS elaborate on its different dispersion models for deep versus shallow water and indicate the extent of field verification for its assumptions. USGS responded that it measured a 27 log R attenuation at 200 m from the source, and that:

*An important attribute of the minisparker that the USGS proposes to use is that the sound source is towed very close to the sea surface, at depths less than 1 m but mainly less than 0.5 m. This shallow tow depth results in most of the sound energy's being projected downward--horizontally directed sound energy diminishes sharply with distance from the source. Horizontally traveling sound is the kind that would most strongly affect marine mammals. Explanations for the strong, horizontal attenuation are in Richardson et al. (1995, p. 73-75) and especially in Urick (1983; p. 130-134) under the topic of "Lloyd mirror." Because of this mirror effect, the sound field around an acoustic source is divided into near-source and far-field zones. For the parameters of the survey proposed by the USGS, the boundary between these zones is located about 5 m from the minisparker. At near-source ranges less than 5 m the amplitude of underwater sound varies spatially in a complex manner. At far-field ranges (greater than about 5 m), however, the amplitude variation is smooth. Theoretically in the far field, sound amplitude decreases according to  $40\log R$ , but because the sea surface is not really a perfect reflector, such strong attenuation is not observed. But sound attenuation like  $25\log R$  could typify horizontally traveling sound.*

*We stress that horizontally traveling sound would most affect marine mammals. Also, attenuation like  $25\log R$  could result solely from the shallow tow depth of the seismic source, irrespective of water depth.*

*In shallow water, additional sound attenuation can result from bottom interaction---sound energy exits from the water layer into the seabottom, so that attenuation with distance is enhanced over what it would be in deep water (Richardson et al., p 68 et seq. and Figure 4.7).*

*We propose that simultaneous action of these two modes of attenuation, makes  $25\log R$  a reasonable estimate for sound attenuation in shallow-water areas of the USGS survey. This belief is bolstered but not proved by the  $27\log R$  attenuation that we actually measured, even though such measurement was done at distances greater than 200 m from the source, ie in the far field zone.*

Another issue of Commission concern has been operations during nighttime and other reduced-visibility conditions (such as fog). In reviewing last year's survey, the Commission objected to USGS' consistency determination because during nighttime operations of the airgun USGS marine mammal monitors would be unable to see the 100 m preclusion area needed for that

airgun for the noise to attenuate to 180 dB. USGS admitted it could only reliably see up to 30 m at night. USGS subsequently modified the project to avoid nighttime operations. For the current survey, USGS calculates the 180 dB preclusion area to be no more than 30 m, a distance which can be effectively monitored because it can be seen at night with the lights USGS will use. USGS therefore proposes 24-hour operations for the current survey, stating:

*Night operations: Because the sound pressure levels are lower, the necessary safety zone is reduced. We propose that the safety zone can be illuminated, and safe operations conducted at night.*

In conclusion, the Commission notes that: (1) USGS would use a minisparker, which would emit a maximum sound level of 209 dB, far less than a typical oil exploration seismic survey (230-259 dB), and quieter than the airgun USGS used in its 1999 survey; (2) the higher frequency supplemental “Huntec” source has not historically raised concerns over effects on marine mammals (its frequency and intensity are comparable to typical underwater bottom profiling sonars); (3) USGS has committed to monitoring and avoiding subjecting marine mammals to above 180 dB; (4) USGS has established a successful track record in monitoring and avoiding adverse effects during past Pacific Ocean surveys; and (5) USGS is also avoiding operating during the gray whale migration period. Considering these factors, the Commission concludes that, with the monitoring and mitigation commitments incorporated by USGS, the proposed surveys would not cause significant adverse reactions or physiological effects on marine resources, and, therefore, that the project is consistent with the marine resource and environmentally sensitive habitat policies (Sections 30230 and 30240) of the Coastal Act.

**B. Commercial and Recreational Fishing.** Section 30230 of the Coastal Act, quoted on page 7 above, provides for the protection of economically (as well as biologically) significant marine species. Section 30234 provides that: “Facilities serving the commercial fishing and recreational boating industries shall be protected and, where feasible, upgraded.” Section 30234.5 provides that: “The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.”

In reviewing last year’s USGS survey, the Commission noted:

*One of the concerns the Commission has historically had with oil exploration seismic surveys, aside from noise issues, has been the multi-mile tow lines attaching the survey ships to the airgun arrays, which can disrupt fishing gear. The proposed USGS’s survey, with its single airgun and short tow line, does not raise this concern, and, as noted in the previous section of this report, the survey would be significantly less noisy than a typical oil exploration seismic survey. These facts, along with the nature of USGS’ survey, which is to continue transiting along a long stretch of coastline over a relatively short period of time, lead to the conclusion that the project will minimize adverse effects on commercial and recreational fishing in the area. The Commission therefore finds that the project is consistent with Sections 30230, 30234 and 30234.5 of the Coastal Act.*



For this year's survey, which will be quieter than last year's, the Commission reiterates these findings and agrees that the project would not adversely affect commercial and recreational fishing and is consistent with Sections 30230, 30234 and 30234.5 of the Coastal Act.

**C. Public Access and Recreation.** Sections 30210-30212 of the Coastal Act provide for the maximization of public access and recreational opportunities. Section 30213 provides that "Lower cost visitor and recreational facilities shall be protected, encouraged, and, where feasible, provided." Section 30220 provides that: "Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses."

In previous Commission reviews of the impacts of Navy acoustic tests on recreational diving activities, the Navy has committed to avoiding active acoustic operations within 0.5 miles of diving activities. In reviewing LFA Phase I research (CD-95-97), the Commission concluded that Navy avoidance of exposing divers to sounds exceeding 130 dB would be adequate, based in part on advice and research from the Navy's Bureau of Medicine and Surgery. USGS has agreed to post Coast Guard Notice to Mariners and to observe a 1 km (0.5 nautical mile) safety zone around any vessels displaying a "diver down" flag. The Commission finds that, with this commitment, the proposed survey will minimize adverse effects on recreational diving in the project vicinity, and that the project is consistent with Sections 30210-30212, 30213 and 30220 of the Coastal Act.

## **VIII. SUBSTANTIVE FILE DOCUMENTS:**

1. Consistency Determination No. CD-32-99, USGS, 1999 Southern California seismic survey, and accompanying monitoring reports.
2. "Low-frequency Sound and Marine Mammals: Current Knowledge and Research Needs, Committee on Low-frequency Sound and Marine Mammals," Ocean Studies Board, Commission on Geosciences, Environment, and Resources, National Research Council, March 21, 1994.
3. "Marine Mammals and Noise," Richardson, W. J., C. R. Greene, et al., New York, Academic Press, 1995.
4. Consistency Determination No. CD-102-99, National Marine Fisheries Service, small test of "pulsed power" acoustic harassment device to protect recreational fishing from sea lions.
5. "Request by the U.S. Geological Survey for an Incidental Harassment Authorization Under the Marine Mammal Protection Act, to Use a Small Airgun Near Marine Mammals in the Southern California Bight," USGS, submitted February 10, 1999.

6. National Marine Fisheries Service, Federal Register Notice of March 5, 1999: “Small Takes of Marine Mammals Incidental to Specified Activities; Seismic Hazards Investigation in Southern California; Notice of receipt of application and proposed authorization for a small take exemption; request for comments.”

7. Consistency Determinations No. CD-95-97 and CD-153-97 (Navy, Low-Frequency Active (LFA) Sonar, Phases I and II).

8. Draft Environmental Assessment for Low-Frequency Sound Scientific Research Program in the Southern California Bight, September/October 1997, National Marine Fisheries Service, June 1997.

9. Consistency Certification CC-110-94/Coastal Development Permit Application 3-95-40, Scripps Institution of Oceanography, Acoustic Thermometry of Ocean Climate (ATOC) Project and Marine Mammal Research Program (MMRP).

10. “Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II: January 1984 migration,” Malme CI, PR Miles, CW Clark, P Tyack and JE Bird, 1984, (Bolt Beranek and Newman Report No. 5586 submitted to Minerals Management Service, U. S. Dept. of the Interior).

11. “Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior,” Malme CI, PR Miles, CW Clark, P Tyack and JE Bird, 1983 (Bolt Beranek and Newman Report No. 5366 submitted to Minerals Management Service, U. S. Dept. of the Interior).

12. Quick Look – Playback of low frequency sound to gray whales migrating past the central California coast – January, 1998, Peter Tyack, Christopher Clark, 23 June 1998.

13. Summary Record and Report SACLANTCEN Bioacoustics Panel, NATO (A. D’Amico, Editor), El Spezia, Italy, 15-17 June 1998.

14. Consistency Determination No. CD-109-98, Advanced Deployable System (ADS) acoustic undersea surveillance system tests.

15. “High Energy Seismic Survey Review Process and Interim Operational Guidelines for Marine Surveys Offshore Southern California,” the High Energy Seismic Survey Team (HESS), for the California State Lands Commission and the U.S. Minerals Management Service Pacific OCS Region, September 1996 – February 1999.